D4.3iii. Identification of potential STORES Renewable Energy Zones

Andrew Blakers and Matt Stocks

Australian National University

June 2018

A renewable energy zone is a region that has characteristics that could make a substantial contribution to increasing the supply of renewable energy. Characteristics that make a renewable energy zone attractive include:

1. Excellent wind
2. Excellent sun
3. High quality STORES sites for short term storage, which can increase the load factor on transmission lines and convert sun/wind following output to load-following output
4. Easy connection to major load centres
5. Anticorrelation of the wind and sun within the zone or between the zone and major load centres (i.e. the wind blows more at night or in winter)
6. Benign geological, hydrological, environmental, heritage, land tenure, access and other characteristics

As explained by AEMO at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan, *"AEMO is preparing an inaugural Integrated System Plan (ISP) for the National Electricity Market … Recommendation 5.1 from the Finkel Review stated: By mid-2018, the Australian Energy Market Operator, supported by transmission network service providers and relevant stakeholders, should develop an integrated grid plan to facilitate the efficient development and connection of renewable energy zones across the National Electricity Market"*

AEMO prepared an Integrated System Plan Consultation Document (downloadable from the website above) which includes the STORES sites identified by ANU (Figure 11, p31 of the ISP document). Figure 1 is copied from the AEMO ISP Consultation Document and shows a range of potential RE zones, most of which contain good STORES sites – as can be seen by reference to Figure 2.

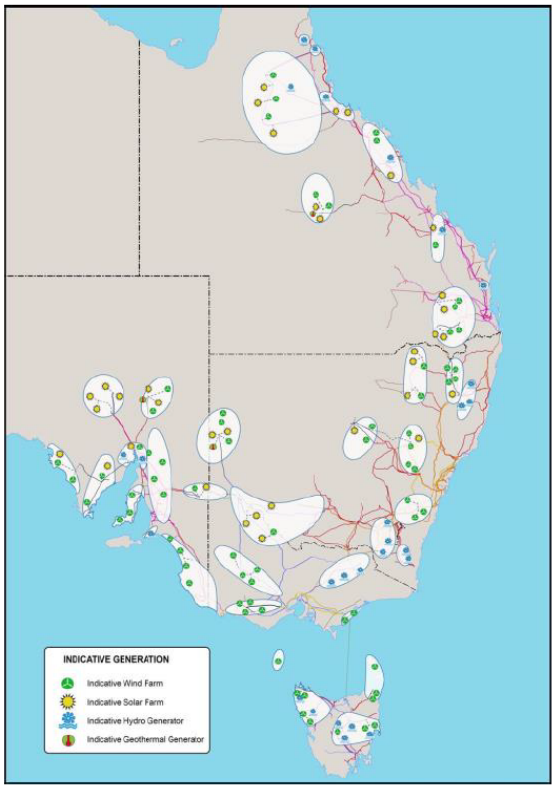


Figure 1: Range of potential Renewable Energy Zones (AEMO, https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan)

The zones identified by AEMO are connected to the NEM. As our STORES site information is elaborated to a wider range of heads and maximum dam wall

heights, and as the cost model becomes integrated with the site data (Gamma cost model), the opportunities for STORES in these zones will come into sharper focus.

Regions that have been identified in the STORES project as attractive RE zones zones:

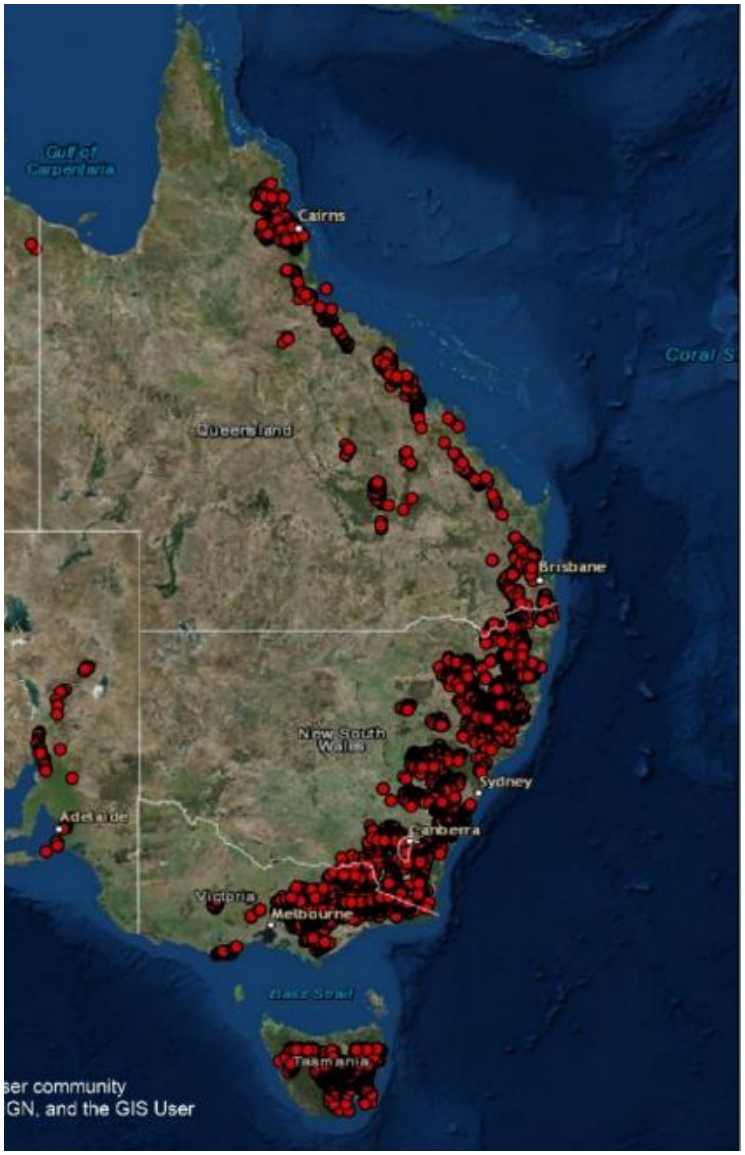


Figure 2: 22,000 potential pumped hydro sites in Australia (http://re100.eng.anu.edu.au/research/phes/)

The Townsville district is a particularly attractive RE zone because it admirably meets all six of the desirable characteristics listed above, and particularly because Townsville weather is rarely correlated with weather in the south.

Alice Springs has excellent wind, sun and STORES sites, and presently relies on expensive gas generators. It is likely that there is good anticorrelation between wind and solar resources in Alice Springs and the southeastern corner of Australia. This region is well within the range of an HVDC link to the NEM if the economics of the connection were justified. This was examined in our paper looking at 100% renewable electricity for the NEM.

Darwin presently relies on expensive gas generators. It has excellent solar resources and good STORES sites are located approximately 160kM to the SW.

Pilbara and Kimberley in north west Australia have some of the best solar resources in the world as well as excellent wind resources, enormous iron ore reserves and extensive opportunities for pumped hydroelectricity storage (PHES). We found 3,400 sites with energy storage potential of 7000 GWh. Large improvements are being made in the transport of electricity via HVDC cables, including undersea cables. Several consortia are examining large-scale transmission of wind/PV electricity from NW Australia to Indonesia. Mass storage in STORES sites allows load-following delivery of power, and also helps cope with problems in the transmission cables.

Figure 3: 1,540 potential pumped storage sites in the Northern Territory with head better than 200m. One group of 440 is located 100-200 kilometres SW of Darwin and another group of 1100 is located near Alice Springs. Detailed information including spreadsheets and synthetic images of every site is available at http://re100.eng.anu.edu.au/research/re/site/nt.php

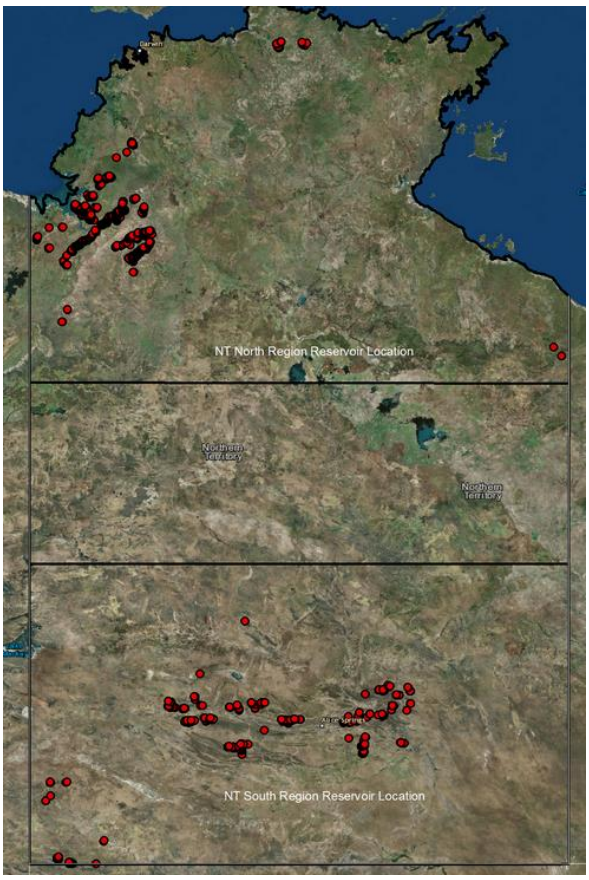
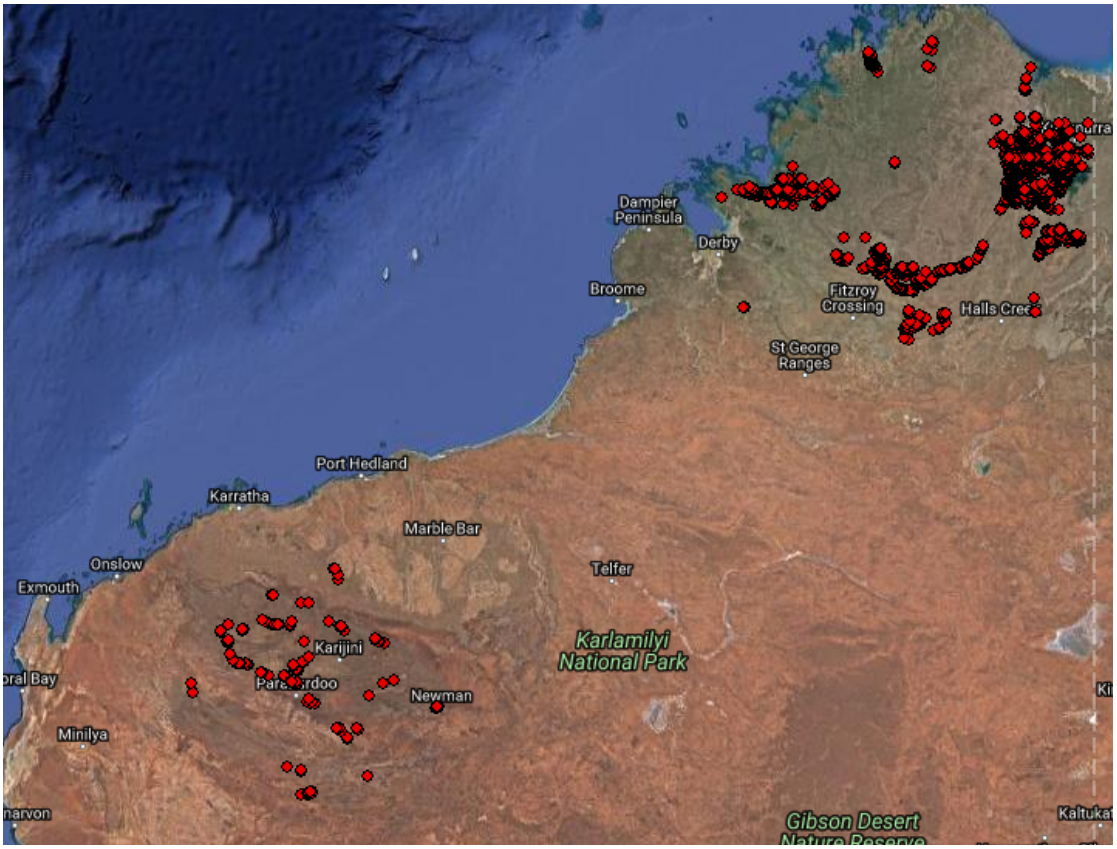


Figure 4: Potential pumped storage sites in the north west



Acknowledgements: the contributions of many people to this work is gratefully acknowledged, particularly Mark Diesendorf who provided valuable comments on the final text. Responsibility for the work is taken by the authors.